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RESEARCH: A RETROSPECT[1]

INASMUCH as the prime object of Sigma Xi is to encourage research by honoring those who possess that rare and priceless gift which we designate as research ability, it seems fitting on this occasion that an attempt be made to illustrate the more important of the varied qualifications essential to success in this high calling.

Among the rare gifts which must be possessed in greater or less degree, intellectual curiosity to know and understand the universe may be singled out as an absolute essential, because perhaps it is the real motive which urges us to investigate. Indeed, may we not say that curiosity is that elusive something which causes organisms to evolve, that upward urge which makes us forever unsatisfied with present attainments. Given that inner urge which intellectual curiosity supplies and even mediocre ability as an observer or some intuition and imagination (attributes which are prime essentials in inductive reasoning) or ability to reason deductively, or all of these, and an investigator is sure to result. Some have all these gifts in a high degree and, if developed, the result is an Aristotle, an Hipparchus, a Roger Bacon, a Darwin, a Faraday or a Newton.

I shall take the liberty of first illustrating these essential qualifications by a brief reference to a history of one of the most fascinating quests which has ever led man to explore the unknown, namely the problem of understanding the universe. In its larger implication we mean by this the problem of finding the position, motion and relationship of each part to every other and the actions and interactions of every conceivable and inconceivable kind between each and every part, including man himself, his inner consciousness and his spiritual nature,—a problem infinite in its scope and in the sweep it allows to the imagination. Only a being divinely endowed, as is man, with the possibility of infinite perfectability would ever contemplate attempting such a task. The most highly gifted race which the world has known attempted to solve this problem by direct assault. Perhaps the most valuable lesson which the ancient Greeks have given to mankind is that the fortifications must be gradually reduced before there is any hope of taking the citadel. I shall, therefore, confine my remarks to a brief outline of the history of the progress which the human race has made in un-

[1] Address to Sigma Xi Initiates at Cornell University, May 15, 1925.

derstanding that small part of this problem which is concerned with finding the positions, motions, actions and interactions of the heavenly bodies. A knowledge of the essential steps in the progress of this phase of the problem of science is a most essential part of the mental equipment of all research workers, because we have here the most complete and easily understood panorama presenting the whole outline of the method of science.

Even before the dawn of written records, man's curiosity about those objects external to his world and hence out of his reach had caused him to complete what is possibly the most notable research in his long history. Reference is made to the discovery that there are two classes of bodies among the heavenly host, namely, the seven wandering bodies, the Sun, the Moon, Mercury, Venus, Mars, Jupiter and Saturn; and the much larger group, the fixed stars. For at least six thousand years, man's curiosity about the so-called fixed stars was in abeyance while he wrestled with the problem which more intensely aroused his curiosity,—the problem of completely explaining the apparently complex motions and relations of the seven wandering bodies. In all this time, the stars were of chief concern only in giving fixed reference points on the sky to be used to mark the stations on the apparent paths of the wandering bodies. In addition, they proved useful in making possible the solution of such problems as the shape and size of his own abode, the Earth, and determining his own position upon it, as well as in marking times and seasons.

Some unknown genius after the time of Thales, but before the time of Aristotle, discovered the rotund form of the earth, an induction based upon the observations of travelers before him and suggested by an idealistic notion that the sphere is the only perfect shape. Eratosthenes, a quarter millennium before Christ, was able to measure the circumference of the earth with a remarkably high degree of precision for that time. Aristarchus, over a century earlier, had determined with considerable accuracy the distance to the Moon in terms of the Earth's diameter. He also used a perfectly valid method for determining the distance to the Sun in terms of the Moon's distance,—a method, however, which is not capable of giving a very high degree of precision. It did, nevertheless, serve a useful purpose in giving a knowledge of the fact that the Sun is much farther away than the Moon and is a larger body than the earth. These early measures were important in giving some information about the relation of man's abode to those heavenly bodies which are most conspicuous and most important to him.

From observations of the stars made by Aristillus and Timocharis, the first astronomers at the Alexandrian University, Hipparchus, about 150 years later, detected the precession of the equinoxes. Hipparchus was also the first to attack systematically the problem of explaining as the resultant of simple motions, the apparently complex motions of the Sun, Moon, and five bright planets. In the absence of the fundamental science of dynamics his explanation was purely kinematical and he made this as simple as possible by following the dictum of Plato in regarding the actual motion as the resultant of a combination of uniform circular motions. The ingenuity and intellectual ability shown by Hipparchus in devising a simple system, consonant with the knowledge of his time, so well suited to explain the observed phenomena and to be used as the basis of deduction for the future, place him among the greatest research men of all time. The detailed working out of his system for the planets awaited more extended observations than could be made in one man's life, and was completed by his admirer, Ptolemy, three centuries later. This system of epicycles and eccentrics devised by Hipparchus, and completed by Ptolemy about 150 A. D. held practically undisputed sway for almost fifteen centuries after the publication of Ptolemy's Almagest. It was only finally displaced by the observations of Tycho Brahe, which in the hands of Kepler led to the discovery of the latter's three laws of planetary motion. These laws of Kepler's were the basis for the great Newtonian induction of a universal gravitative force varying inversely as the square of the distance between the centers of attraction. These laws, with the experimental work of Galileo in dynamics, also led Newton to divine the laws of motion.

The laws of motion and the law of gravitation are the basis of a dynamical system so complete and so satisfactory that even to-day, with the precision of observations far surpassing the wildest hopes of such keen and careful observers as Tycho Brahe, Flamstead, or even Bradley, only one minute discrepancy exists between observation and what Newtonian theory predicts. Even this discrepancy is most probably due to lack of sufficient refinement in our observations or a lack of knowledge of some more elusive force than gravitation, or of both of these.

But my object now is not to minutely review that most brilliant epoch in the history of science, beginning with Tycho Brahe, Galileo and Kepler, culminating in Newton and ending with Laplace, a period which at its end saw the problem of the structure of the solar system completely solved so far as dynamical considerations were concerned. All the steps in the scientific method are illustrated by the achievement of this period and it constitutes the most complete illustration which we possess.

This period and its solution of one phase of the problem of the structure of the universe is but an episode in the gradual revealing of the throbbing life of the universe. Sir William Herschel was the pioneer in recalling man's interest to the larger problem of determining the structure of our galactic system. "He pierced the barrier of the skies" and reawakened man's slumbering curiosity about the stars, a curiosity which was further stimulated by the revelations which the vibrant ether brings us in the form of light. Newton commenced the research which revealed the composite nature of white light and the possibility by its analysis of learning something of its nature. He was only prevented from going further by the imperfection in the art of glass making. Fraunhofer immensely improved said art and his curiosity, stimulated by the discovery of nature's marvelous hieroglyphics, which in deference to his great genius we have named the Fraunhofer lines, made vast strides in their interpretation. Together with this, the further leap made by Kirchhoff opened up vast new vistas, not only into our galactic system, but into the marvellous beauty and order revealed in the vibrant atom, that infinitesimal little galaxy of electrons and perhaps of even still smaller units. The discovery of the principles of spectrum analysis and the new conceptions which it has opened before our vision make clear other relationships than merely dynamical which are undermining the vicious hold and influence which the conception of the universe as a vast machine or an assemblage of intricate mechanisms has had upon the human race. It has been one of the profoundest facts revealing to us the unity of the universe and at the same time enormously extending our conception of it.

That some at least of the nebulae were distant galactic systems was conjectured by Herschel, and later, when the spectroscope made possible a scientific classification of these objects, many keen-visioned souls conjectured yet more confidently that the spiral nebula are distinct galactic systems.

The discovery of novae in the spirals and the ability to recognize them as a distinct class of celestial bodies further confirmed this conjecture and raised it to the rank of a hypothesis. The telescopic and spectroscopic revelations of systems of stars among the vast assemblage of our galactic host, has made possible a more complete solution of the problem of its structure, possibilities greatly increased by the discovery of those marvellous pulsating suns known as cepheid variables. Study of these variables in globular systems of stars, together with spectroscopic evidence as to intrinsic brilliance of stars, made possible to Shapley, a decade ago, the means of determining the distance of these globular clusters whose inner structure may be divined through observations combined with deduction from dynamical principles. By the aid of great telescopes and spectroscopes, made possible by the tremendous advances in engineering and optical skill, Hubble and others have partially resolved the nearer spirals into stars. Among these stars are cepheid variables and just as they have been the plummet which has enabled us to sound the depths of our own galactic system, so now they confirm still more certainly the conception that the spiral nebulae are distant galactic systems. A million of these are now within our ken by using to the full our present means of exploring them.

What wonders and marvels await the seeing eye and the understanding mind no man can tell, but certain it is that when the history of our own epoch is written in some far distant day, it will be justly regarded the most interesting time before 1925 in which to live, the one in which the finest opportunities are open to the intellectually curious who also develop to the full the mental capacity with which they are endowed.

Initiates, your election to this society is in itself evidence that you have this intellectual curiosity and have at least partially developed the mental capacities with which you are endowed. See to it that you let not this torch slip from you—develop your research capacity to the full and carry on the torch of science to light the new world which is to be. So live, in the light of what biological science is revealing, as to have strong and healthy bodies, the abodes of spirits sensitive to receive impulses over the widest possible range of notes from the vibrant, throbbing life of the universe.

S. L. BOOTHROYD

CORNELL UNIVERSITY

DROSOPHILA AND THE MUTATION HYPOTHESIS

FOR two decades the hypothesis of mutation or the saltatory origin of species has enjoyed a large vogue in American biological laboratories. In its present form, it was first formulated on the botanical side as the result of the investigations of the Dutch physiologist, De Vries, on Lamarck's evening primrose, *Oenothera lamarckiana*. In this species De Vries, as is well known, observed the appearance of a relatively small number of forms from seed, which differed in marked degree from the parent species. This author gave names to these variants and considered them to be elementary or inchoative species. Subsequently it was observed that many of the species of the genus Oenothera were capable of acting in the same manner as *O. lamarckiana*, in cultures and in a few cases the number of aberrant individuals differ-

ing from the parent form reached enormous proportions. It is now very generally conceded, even by geneticists and physiologists, that the species of the genus Oenothera often present strong evidence of hybrid origin, and the mutability frequently found in their offspring receives its obvious explanation as the result of previous crossing.

In 1906, shortly after De Vries introduced his hypothesis of mutation to the United States, in a course of lectures delivered in the University of California, Castle called attention to the extraordinary variability of the offspring of the fruit of pomace fly, *Drosophila melanogaster*. Later, Morgan, who had previously given much attention to the development of the cells of sex, particularly in insects, put forward a theory of mutation parallel to that of De Vries, based on the conduct of the minute dipterous fly, Drosophila, in cultures. A very large number of so-called mutants were isolated from the wild *D. melanogaster,* and these have presented a fertile field for the study of Mendelian ratios, when crossed with one another. So convenient have the so-called elementary species or mutants of Drosophila proved in this respect that they are now almost universally kept under culture in our biological laboratories in connection with the illustration of general principles of heredity. The ease and rapidity with which the pomace fly can be bred has doubtless largely led to this situation.

A notable feature of the genetical study of the pomace fly is the establishment of the so-called chromosome theory of heredity. In this connection, extensive studies of the chromosomes in Drosophila have been made by the geneticists of the Morgan school. It may be truly stated, in fact, that American genetics is mainly based on the experimental study of the fruit fly and this appears to be equally true of the subject both on the botanical and zoological sides, for it is in universal use in biological laboratories for genetical purposes.

The general impression doubtless is that the genus under discussion has been very thoroughly studied both in its genetical and cytological aspects and that a close correlation has been established between these two lines of activity. When the present writer had occasion to look into the cytological literature, however, he discovered to his surprise that no account or rather no adequate account had been given of the all-important reduction, meiotic or maturation divisions, in *Drosophila melanogaster*. The only author who has really dealt with the matter at all is Stevens.[1]

[1] N. M. Stevens, "A study of the germ cells of certain diptera, with reference to the heterochromosomes and the phenomena of synapsis," *Journal Exp. Zool.*, Vol. 5, 1907–1908.

This author refers to the technical difficulties connected with the study of Drosophila and after having examined some two thousand individuals in the course of a year expressed the opinion that the subject was not yet cleared up. The procedure mainly employed by Miss Stevens was teasing out in Schneider's aceto-carmine, a method which Metz later characterized as producing both distortion and displacement of the chromosomes. Certainly Miss Stevens's figures of the reduction or meiotic division of *D. melanogaster* must rank as the most bizarre which have ever been published of meiosis in the spermatocytes of insects. Later, Metz[2] attacked the same subject and after criticizing the unsatisfactory results reached with the aceto-carmine smear method, as indicated above, states that the maturation (meiotic, reduction) divisions in Drosophila are difficult to study. He gives no figure of meiosis in the species *D. melanogaster*. Thus we have no adequate information as to the critical meiotic mitoses in a genus upon which, in recent years, a whole theory of evolution has been established. This is truly a remarkable state of affairs and one as will be shown in the sequel of the deepest significance.

The difficulties connected with the cytological investigation of the all-important meiotic or maturation divisions in the genital glands of Drosophila depend mainly on the small size and extremely tortuous configuration of the organs. This condition makes it almost impossible to secure longitudinal sections of any considerable length. The proper fixation of the material is a less serious matter, as the use of highly penetrating preservatives such as Carnoy's absolute alcohol, chloroform and acetic acid, in conjunction with a quickly acting and powerful air pump, largely obviates indifferent preservation. The small size and contorted form of the testicles has been overcome by the development of quantity methods for sectioning. Forty to fifty pupae are attached to blotting paper by means of glycerine albumin fixative and the whole lot sectioned at once by the nitrocellulose method, which has the advantage of obviating the shrinkage resulting from the use of paraffine.

During several years past much attention has been given in my laboratories to the study of the cytology of hybrids, the importance of which was first clearly emphasized by Rosenberg in his epochal investigations on a hybrid Sundew (*D. ovata, D. anglica* of authors). It has since become increasingly obvious on the botanical side both that large numbers of species of plants are of hybrid origin and that these hybrid species, as well as known hybrids, give rise

[2] Charles W. Metz, "Chromosome studies on the diptera," II., *Journal Exp. Zool.*, Vol. XXI, 1916.

to phenomena in cultures, exactly similar to those found in Oenothera and Drosophila.

An investigation of the meiotic divisions in the reproductive organs of *Drosophila melanogaster* by the quantitative methods indicated above has resulted in the securing of large numbers of mitoses. These are throughout thoroughly abnormal and of the hybrid type. The normal simultaneous movement of the chromosomes (metaphase) to the equator of the cell, to constitute the so-called equatorial plate, is conspicuous by its absence in this species. Abnormalities in the anaphase are equally obvious, as there is the same lagging of the chromosomes in their progress towards the poles as manifests itself in the earlier equatorial migration. I have examined hundreds of divisions of the spermatocytes of *D. melanogaster,* without observing a single normal mitosis in the so-called heterotypic (meiotic, reduction, maturation) division. The all-important reduction divisions of *D. melanogaster* are undoubtedly aberrant and present the identical peculiarities of those observed in known hybrids. The cytological investigation of *Drosophila melanogaster* seems accordingly to establish beyond any reasonable doubt that the species is of hybrid origin and that accordingly very large and indeed fundamental reservations must be made, in any general conclusions, regarding the origin of species, and the laws of heredity, which can be drawn from the experimental study of this species.

These erroneous results, which have apparently been reached as a consequence of too superficial study in the case of *Drosophila melanogaster,* present an excellent example of the dangers of what may be called the *in vitro* or purely experimental study in the biological sciences. A number of biologists are apparently of the opinion that studies carried on in glassware, greenhouses or laboratories have a fundamental value and transcend in importance other kinds of biological investigation. It is necessary, however, to correlate the results seen at best, but darkly, in the glass experimental houses with those obtained by the study of living matter in the open, in other words, in nature. This was essentially the method pursued by Charles Darwin, who compared the only experimental evidence in general available in his time, namely, that furnished by cultivated plants and domesticated animals, with the conditions presented by plants and animals in nature. A large part of the perennial value of the "Origin of Species" is the result of this broad and solid method.

The extreme experimentalists, moreover, have apparently forgotten a very old and extremely prudent adage, namely, that those who live in glass houses should not throw stones. Professor Morgan in his "Critique of the Theory of Evolution," which has enjoyed a tremendous vogue in recent years, has damned with faint praise or attempted to controvert many of the fundamental principles of the biological sciences and has attempted to set up in place of them an evolutionary hypothesis based on the study of a single aberrant species of Drosophila. There is an interesting contrast between the Morgan hypothesis and that of Charles Darwin. The latter was able to buttress his views with the conclusions reached by morphologists, paleontologists, embryologists and biogeographers. In spite of the strong support supplied by the general biological situation in Darwin's time his hypothesis met with the bitterest opposition. The Morgan hypothesis of mutation based on the study of *Drosophila melanogaster* by contrast runs counter to practically all the inductive conclusions of the biological sciences. In contrast to the Darwinian hypothesis, moreover, it has been acclaimed at once by almost the entire body of biologists. The history of science appears to warrant no expectation of long life for the mutation hypothesis. It is, moreover, inconceivable that a science which has reached as its supreme achievement the theory of evolution should itself progress by unreasoning revolution and the subversion of the fundamentals of the biological sciences. It is in fact not impossible that before many years have elapsed the doctrine of mutation will appear to the eyes of men as a fantastic Fata Morgana, appropriately staged on the exaggerated skyline of the lower Hudson.

EDWARD C. JEFFREY

BOTANICAL LABORATORIES,
HARVARD UNIVERSITY

REPORT OF THE COMMITTEE OF THE NATIONAL ACADEMY OF SCIENCES ON FORESTRY PROBLEMS

THE Special Committee of the National Academy of Sciences on Forestry Problems in the United States appointed at the annual meeting in April, 1924, respectfully reports as follows:

1. There is urgent national need for the clearer definition and active prosecution of a sound forestry policy. (Herewith is submitted Exhibit A—a report on forestry research by a sub-committee under chairmanship of Henry S. Graves.)

2. The formulation and development of this policy must be based upon researches in the fundamentals of science underlying forestry, including plant morphology, physiology, taxonomy, genetics and pathology correlated with biochemistry and biophysics and recognizing certain aspects of economics.

3. Such researches are especially difficult because of the time element involved and therefore are to an

unusual degree dependent upon assured permanence of plan and reliability of support.

4. Plans for the improvement of present conditions should give consideration to:

(a) The finding and training of especially promising young men for constructive effort and future leadership in this field of research.

(b) The encouragement of mature investigators working on pertinent problems.

(c) The possible increase of that which is of best import in researches supported by federal funds.

(d) Additional support of pertinent work in existing educational and research institutions other than federal.

(e) The possible need and place of a new research institution or agencies and the proper correlation of such with existing educational and research institutions or agencies.

Recognizing these factors it is evident that further progress in detailed consideration of these matters requires adequate understanding of pertinent existing undertakings and agencies by which the needs are now being met or may be met.

6. It is, therefore, recommended that a special committee of the academy be appointed to advance the realization of these objectives with the understanding that the first step should be the securing of the financial support for a survey.

L. R. Jones,
Chairman

The above report and recommendations of the committee on forestry problems in the United States was considered by the council of the National Academy of Sciences at its meeting on April 26, 1925, and the following motion was adopted:

Moved: That the council recommend to the Academy that the Academy express its continued interest in the forestry problem, and that a special committee of the Academy be appointed to advance the needs recommended in the report of the committee on forestry problems as presented.

Adopted.

The recommendation of the council of the Academy, including the report of the committee on forestry, was presented to the Academy at its business session on April 27, 1925, and after discussion the following resolution was adopted:

Resolved: That in approving the recommendation of the council, the National Academy of Sciences expresses its continued interest in the forest problem, and authorizes the appointment of a committee to advance realization of the objectives set forth in the report as presented, with the understanding that the first steps will be the securing of financial support for the survey, and the supervision of such a survey.

Adopted.

The committee on forestry is as follows: L. R. Jones, chairman; I. W. Bailey, H. S. Graves, R. A. Harper, J. C. Merriam, E. D. Merrill, C. D. Walcott.

HENRY M. THOMAS

It is thirty-six years since the Johns Hopkins Hospital opened its doors. The little group of men that were gathered together in its early years is dwindling. How fast they have gone!—Gilman, Mall, Osler, Halsted and now "Harry" Thomas.

> As life runs on the road grows strange
> With faces new, and near the end
> The milestones into headstones change,
> 'Neath every one a friend.

Beneath the new headstone will rest one who filled a large place in the hearts of his remaining colleagues and students. A neurologist whose learning and ability and discrimination were widely recognized and valued, Thomas is a sad loss to the medical profession. Modest, unassuming, unobtrusive, he was a careful, thorough, learned student, a keen observer, a wise adviser, a judicious teacher; unselfish, devoted, self-sacrificing, he made every student his friend. It is doubtful if there was one among the faculty, unless it were the "Chief," whose personal relations with the students were so close. These students he taught to approach their problems deliberately, thoughtfully, thoroughly; to reach their conclusions only after the most careful collection and consideration of all available evidence.

"What is scientific reasoning?" said Duclaux, "simply this: reasoning exercised with the salutary fear of self-deceit and the firm resolve to avoid it." This lesson Thomas taught his students well. And then he taught them another lesson, a lesson of gentleness and consideration and humanity and tolerance toward patient and fellow man, high and low.

He was a gentleman and whosoever came into his presence—patient or colleague or student—left him with the sense that he had been treated as a gentleman. Few lessons are more precious than this.

With his patients he had an extraordinarily bright, fresh, cheering manner, and a capacity for diverting small talk on all occasions which was the despair of his less favored colleague and the joy of many a discouraged invalid.

He was a member of the Society of Friends—a member of the Society of Friends—pleasant words, and in how many senses true!

W. S. T.

SCIENTIFIC EVENTS

FARADAY'S DISCOVERY OF BENZENE[1]

IN his discourse at the Royal Institution, on Friday, June 12, on Faraday as a chemist, Sir William Pope reminded his hearers that Faraday devoted his life to experimental research in chemistry and physics in the Royal Institution, and, at his death in 1867, he was mourned as one of the greatest natural philosophers of the early part of the nineteenth century. Faraday made his advent as a scientific investigator at a moment when striking advances in chemistry were imminent and were indeed to be foreseen; the work of his immediate predecessors, Lavoisier, Davy, Dalton, Berzelius and Avogadro, had made of chemistry an exact science, and such a genius as Faraday was needed for the development of experimental methods. He worked on a variety of chemical subjects for several years, and on June 16, 1825, laid before the Royal Society the results of his study of the liquid deposited from compressed oil gas, in the course of which he had discovered the compound of carbon and hydrogen now known as benzene. At this centenary of his discovery, we celebrate the anniversary of the initiation of a large branch of organic chemistry which in later years became of great scientific importance and, in addition, became the foundation of the several vast industries. Among these latter are to be numbered not only the manufacture of coal-tar dyes, but also important sections of the pharmaceutical, photographic and petroleum industries. Faraday was the first to make a quantitative study of the chemical changes which result from electrical action, and discovered certain electrochemical laws which are of profound chemical significance. He also carried on numerous investigations on optical glass, steel alloys, the transparency of very thin sheets of gold and the so-called colloidal solutions of metallic gold in water.

On June 16, the centenary of Faraday's discovery of benzene was celebrated at a full gathering in the historic lecture-theater of the Royal Institution. His Grace the Duke of Northumberland presided, and in his opening remarks directed the attention of the rising generation to the motives which had inspired Faraday's life, to his profound trust in facts of observation and to his scientific use of the imagination. Although manufacturers have come to recognize the value of such work as Faraday's, in government circles there is still failure to link up scientific methods and discoveries with the public service. His Grace then presented diplomas of honorary membership of the Royal Institution to Professor E. Bertrand (Paris), Professor E. Cohen (Utrecht), Prince Ginori-Conti (Italy) (through his representative Dr. G. A. Nasini), Professor J. F. Norris (Boston), and Professor G. Sakurai (through Professor M. Katayama), who were introduced individually by Sir Arthur Keith, secretary of the institution. Appreciations of Faraday's work were delivered by Professor H. E. Armstrong, who dealt mainly with the organic chemical aspect, and Professor Ernst Cohen, who spoke as a physical chemist. Professor Armstrong stated that the committee organizing the celebration had decided to award at intervals—perhaps sexennially—a medal for conspicuous achievement having some relation to Faraday's discovery of benzene. The first award would be made to Mr. James Morton, of Grangemouth, for distinguished work in connection with the manufacture and applications of anthracene dyestuffs.

[1] From *Nature*.

FREEDOM OF TEACHING

AT a meeting of the Southern California Sigma Xi Association held at the University of Southern California on June 2 the following resolution was unanimously adopted and the secretary of the association directed to transmit copies to the several papers published in Los Angeles and also to the editor of SCIENCE with a request that publication be made in order that the position of the association might become known:

Resolved, That the Southern California Association of Sigma Xi view with amazement and concern the propaganda that is going on in certain parts of the country, having as its object the restriction of the freedom of teaching in science. We would remind the thinking public

(1) That our civil, religious, intellectual and economic progress have resulted very largely from this freedom within the schools, colleges and universities of the land. To attempt to take away this constitutional right is to return to the methods of the Middle Ages.

(2) We call attention to certain essential characteristics of the method of science:

(a) The sincere search for truth without reference to the effect of such truth upon previous opinion or belief.

(b) That any statement of the findings of science is in the nature of the case a statement of the balance of evidence and not a dogmatic assertion of finality. Even the "law" of gravity is subject to revision or restatement.

(c) That there is and can be no conflict between religion and science: to assert the contrary is to misunderstand the scope of both.

(3) We urge all representatives of science in school, college or university to:

(a) Inculcate a love for zealous research after truth and loyalty to that truth when found:

(b) Exemplify in their own attitude both the dignity of science and the proper restraint of the workman in science; only so can we deserve the support of enlightened public opinion.

(4) That we hereby express our hearty approval of the American Association for the Advancement of Science in its effort to assist in reaching a prompt, clear and just understanding in regard to the rights of teachers of science.

EXPENDITURES OF THE ROCKEFELLER FOUNDATION

A SUMMARY of the expenditures of the Foundation in 1924 is presented in the following table. A detailed financial statement will appear in the annual report.

PUBLIC HEALTH	
International Health Board—hookworm disease, malaria, yellow fever, county health work, laboratory service, fellowships, etc.	$2,536,334
Mental hygiene	47,778
Hospital, Dispensary and Nursing Studies	182,034
School of Public Health, Harvard University	425,000
National Health Council	4,805
MEDICAL EDUCATION	
China Medical Board	1,146,298
Canadian Medical Program	513,664
University of Oxford	240,116
State University of Iowa	450,000
Free University of Brussels	144,000
University of Hongkong	127,812
Four other universities	162,118
Central Europe—Journals and Apparatus	73,275
Fellowships, studies, etc.	367,744
MISCELLANEOUS	
Marine Biological Laboratory, Woods Hole, Mass.	500,000
Fellowships in Physics, Chemistry and the Biological Sciences	127,116
Payments on ten-year pledges to educational enterprises	27,500
Relief work in Japan	18,373
Concilium Bibliographicum, Zürich	15,000
Shakespeare Memorial Trustees	6,585
Special Studies	5,089
National Information Bureau	1,000
ADMINISTRATION	
Executive Offices	167,181
Total	$7,288,822

THE SOUTHAMPTON MEETING OF THE BRITISH ASSOCIATION

THE British Association has issued the preliminary program of its annual meeting which will take place in Southampton from August 26 to September 2, inclusive, under the presidency of Dr. Horace Lamb, lately professor of mathematics in the University of Manchester.

Southampton, which the association has not visited since 1882, is a focal point of oversea communications, and with this feature and the railway centenary of the present year in view, the program gives special attention to various aspects of transport. This will form the subject of two days' discussion in the sections of economics and engineering jointly, while Sir Archibald Denny, as president of the engineering section, will give an address on "Fifty years' evolution in naval architecture and marine engineering," and an evening lecture will be given by Mr. R. V. Southwell on "Aeronautical problems of the past and of the future."

Among other addresses, that to the physical section by its president, Dr. G. C. Simpson, director of the Meteorological Office, will deal with "The new idea in meteorology." The address by Mr. A. R. Hinks, secretary of the Royal Geographical Society, as president of the geographical section, will be concerned with the science and art of map-making, a subject appropriate to the town which is the home of the Ordnance Survey. Professor A. V. Hill will speak in the physiological section on "The physiological basis of athletic records." Mr. Tate Regan, in the chair of the zoology section, will deal with "Organic evolution: facts and theories." Mr. W. W. Vaughan, headmaster of Rugby, will address the educational section on "The warp and the woof in education." Miss Lynda Grier, principal of Lady Margaret Hall, Oxford, will take "The meaning of wages" as the subject of her address as president of the section of economics. Other subjects for discussion in the sections are the cost of farming and the marketing of agricultural produce; health in schools; the functional significance of size; the ignition of gases; the botanical geography of tidal lands; variations in gravitational force and direction, and recent investigations in the modern psychological field of vocational guidance.

SCIENTIFIC NOTES AND NEWS

DR. ROBERT G. AITKEN, director of the Lick Observatory, has been elected president of the Pacific Division of the American Association for the Advancement of Science.

AT the commencement of Brown University on June 17, the first award of the Susan Colvin-Rosen-

berger medal of honor of Brown University was made by the faculty to Dr. William W. Keen, of Philadelphia.

PROFESSOR G. H. PARKER, director of the Harvard Zoological Laboratory, has been elected to honorary membership in the American Otological Society.

DR. LEO LOEB, professor of pathology, Washington University School of Medicine, St. Louis, has been elected a foreign member of the "Deutsches Zentralkomitee zur Erforschung und Bekämpfung der Krebskrankheit."

DR. EDWARD CURTIS FRANKLIN, professor of chemistry, Leland Stanford University, has received the degree of doctor of science from Northwestern University.

DR. DAVID WHITE, of the United States Geological Survey, received the honorary degree of doctor of science from Williams College on June 22.

RALPH ARNOLD, geologist and petroleum engineer, received the degree of doctor of engineering from the University of Southern California on June 18.

DR. HUBERT WORK, secretary of the interior, and former president of the American Medical Association, delivered the commencement address at the University of Colorado on June 15, on which occasion he received the degree of doctor of laws.

HONORARY degrees conferred by the University of Pennsylvania at its commencement exercises on June 17 include the following: the doctorate of laws on Dr. Livingston Farrand, president of Cornell University; the doctorate of science on Dr. John Robbins Mohler, chief of the Bureau of Animal Husbandry, Washington, and on Dr. Alfred Newton Richards, professor of pharmacology at the University of Pennsylvania.

FOR distinguished services in public health, hygiene and original work in protective serums, Dr. William H. Park, on May 14, received the gold medal of the National Institute of Social Sciences.

ON the occasion of a meeting to celebrate the twenty-fifth anniversary of the College Entrance Examination Board, Dr. Thomas Scott Fiske, secretary of the board and professor of mathematics in Columbia University, was presented with a silver bowl and a gold purse.

To commemorate the seventieth birthday of Professor Bohuslav Brauner, of the Charles' University, Prague, his friends and pupils have published a jubilee number of the *Recueil des Travaux Chimiques des Pays-Bas*. The volume contains 33 original papers on research work in all branches of pure chemistry, covering 350 pages.

SIR CHARLES T. RUTHEN has been elected president of the Institution of Structural Engineers, England.

DR. AUGUSTE PETIT, of the Pasteur Institute, Paris, has been elected a member of the Paris Academy of Medicine in place of the late Dr. Jean Camus.

DR. JOHN M. COULTER, who recently retired from the professorship of botany at the University of Chicago, will be on the staff of the Lincoln School of Teachers College, Columbia University, during the next academic year. Dr. Coulter will also act as general adviser in the work of the Boyce Thompson Institute for Plant Research, and will reside in Yonkers, N. Y.

EDWIN R. MARTIN, assistant professor of electric power engineering at the University of Minnesota, has resigned in order to take a position in the industrial power division of the Westinghouse Electric and Manufacturing Company at East Pittsburgh.

PROFESSOR SIDNEY DEAN TOWNLEY, of Stanford University, has been appointed visiting lecturer on astronomy at Harvard University for the academic year 1925–26. He will take the place of Assistant Professor Harlan T. Stetson, who will be on leave of absence.

DR. WARO NAKAHARA, of the Rockefeller Institute for Medical Research, has been appointed associate pathologist at the government institute for infectious diseases, Tokyo Imperial University, and research associate in the division of experimental therapy at the Institute of Physical and Chemical Research, Tokyo.

DR. GEO. D. SHEPARDSON, head of the department of electrical engineering at the University of Minnesota, has been granted a sabbatical furlough for the year 1925–26, which will be spent largely in foreign travel. During his absence, Professor F. W. Springer will be acting head of the department.

DR. ALBERT EINSTEIN has returned to Germany, following a three months' visit to Brazil and the Argentine.

DR. C. H. BEST, the associate of Dr. Banting in the discovery of insulin, leaves Toronto in July for Europe, where he will spend a year in medical research.

MISS ANNIE J. CANNON sailed for England on June 1, to visit observatories in England and in France and to attend the triennial meeting of the International Astronomical Union at Cambridge, England, in July.

EDWIN R. EMBREE, secretary of the Rockefeller Foundation, will leave this summer for a year or more on behalf of the foundation in the countries of the

Pacific, visiting universities and investigators in the biological sciences.

Professor C. W. Edmunds, of the University of Michigan Medical School, has been invited by the Health Committee of the League of Nations to attend a conference to be held in Geneva on international standards which are to be adopted for a number of important drugs and medicines. He will sail the latter part of July.

Dr. Charles L. Parsons, secretary of the American Chemical Society, has sailed from New York to attend the meeting of the International Union of Pure and Applied Chemistry at Bucharest.

Dr. Robert B. Osgood, professor of orthopedic surgery at the Harvard Medical School, has been invited to deliver the first lecture of the Owen Orthopedic Foundation in London, England.

Dr. Reynold A. Spaeth died from septicemia on June 26 in Siam, where he had gone under the auspices of the Rockefeller Foundation to assist in the reorganization of the University of Bangkok. Dr. Spaeth was thirty-eight years old and had been associate professor of physiology in the school of hygiene and public health of the Johns Hopkins University.

Dr. William Curtis Farabee, curator of the American section of the University of Pennsylvania Museum, died at the age of sixty years on June 24 after a long illness following from his South American explorations.

Senator E. F. Ladd, formerly professor of chemistry at North Dakota College and president of the Agricultural Experiment Station, died on June 22 at the age of sixty-five years.

Rear Admiral Joseph Edgar Craig, at one time chief of the U. S. Hydrographic Office, died on June 21, aged eighty years.

Dr. Albert Heald Van Vleet, professor of botany in the University of Oklahoma since 1898 and dean of the graduate school since 1909, died at his home in Norman, Oklahoma, on June 22, aged sixty-four years.

Richard M. Hunt, assistant curator at the Museum of Vertebrate Zoology at the University of California, died on June 25.

In the presence of a large and distinguished gathering in the University Museum at Oxford University on June 10, the vice-chancellor unveiled and accepted on behalf of the university a bronze plaque which has been affixed in the building to the memory of Sir William Osler, late Regius professor of medicine. The plaque is the work of M. Vernor, of Paris. Sir Herbert Warren, president of Magdalen, presented the plaque on behalf of the subscribers, and after the unveiling a wreath of laurel was placed at its foot by Mr. Fulton (Magdalen), representing the Inter-State Post-Graduate Assembly of American Physicians and Surgeons. Sir Humphry Rolleston, president of the Royal College of Physicians and Regius professor of physic in the University of Cambridge, paid a tribute to Sir William Osler.

The American Society of Plant Physiologists will meet, by invitation, with the Corn Belt Section of the American Society of Agronomy at Michigan State College, East Lansing, Michigan, on July 9 and 10. The meeting is to be a field meeting and offers opportunity for plant physiologists and agronomists to get together on common ground.

The Sixth International Chemistry Conference convened in Bucharest on June 26. Previous congresses have met in Rome, Brussels, Lyons, Cambridge and Copenhagen. About 150 delegates from 17 different countries, representing various chemical societies, attended the four-day conference.

The thirty-sixth congress of the Royal Sanitary Institute will be held at Edinburgh University from July 20 to 25. Sir John Gilmour, secretary for Scotland, as president, will deliver his inaugural address to the congress on Monday, July 20. Six hundred and seventy-five delegates have been appointed from nearly 400 sanitary authorities.

According to *Nature*, the Italian government and the International Institute of Agriculture have established a joint committee to organize a World's Forestry Congress, which will be held at Rome early in May, 1926. Experts in forestry and representatives of the timber and allied industries are expected to attend from all parts of the world. The provisional program of the congress embraces a wide range of subjects, on which reports and papers will be read and discussed. At the same time there will be held, in connection with the International Fair at Milan, an exhibition of forest products and of the machinery used in the conversion of timber. Various excursions to Italian forests will be planned to follow on the conclusion of the congress.

The University of Toronto has received a grant of $50,000 from the Laura Spelman Rockefeller Memorial Foundation for work in the field of child study. The grant is on the basis of $10,000 per annum for five years, to which an additional sum is being contributed through the efforts of the Canadian Mental Hygiene Committee. A similar grant has been given to McGill University for child work in Montreal.

The International Health Board, New York, has

offered £1,000 a year for five years to establish a chair of tropical sanitation and hygiene at the Imperial College of Tropical Agriculture at St. Augustine, Trinidad.

A FOUNDATION fund of $50,000 for the first Connecticut college of pharmacy, which will be situated in the old Yale Medical School Building, at New Haven, is being subscribed by the wholesale and retail druggists of Connecticut. Curtis B. Gladding, of Hartford, has been named president of the new college, which opens next fall.

A FUND to be known as the Roald Amundsen Foundation for the Advancement of Norwegian Geographic Research has been established by the Aeronautic Association of Norway. Already 750 subscriptions have been received to be placed at the explorer's disposal.

THE Commonwealth Fund of New York City has established five fellowships in neuro-psychiatry in the Graduate Medical School of the University of Pennsylvania. These fellowships are for three years and are for the purpose of training candidates in conjunction with the newly established Child's Guidance Clinic. The course is similar to the three years' course of the graduate school, but special emphasis will be paid in the last year to child's guidance work. The stipend will be about $2,000 a year.

THE Johnston-Lavis geophysical collection, which was bequeathed to the University of London by the late Dr. Henry James Johnston-Lavis, was formally opened at University College on June 25. The opening ceremony was performed by Sir Henry A. Miers, F.R.S., vice-chancellor of the University of Manchester.

THE Newport Chemical Works, Inc., of Passaic, N. J., according to *Metallurgical and Chemical Engineering,* is establishing a complete experimental station in connection with a projected research program for the development and testing of flotation agents. J. C. Williams, formerly superintendent of the Colorado School of Mines Experimental Station, has been added to the staff to direct the proposed work.

ACCORDING to the Italian correspondent of the *Journal* of the American Medical Association, ceremonies in celebration of the laying of the cornerstone of a new institute for cancer research were recently held in Milan. The founding in Italy of an institution of a type similar to those already established in the United States, in England and in Germany is due to the initiative of the communal council of Milan, of which Senator Mangiagalli, professor in the University of Milan, is the president. A public subscription was opened to raise the necessary funds, and in a few months about 10,000,000 liras had been subscribed. The institute is to be erected in the vicinity of the university and it is thought that it can begin to function in November, 1926.

WE learn from the London *Times* that the ship *Discovery,* which was used by the late Captain R. F. Scott in his Antarctic Expedition of 1901–04, has been reconstructed in the yard of Messrs. Vosper and Co., Portsmouth, for another period of service in Antarctic seas. In 1923 the vessel was acquired from the Hudson Bay Company, into whose possession she had passed, for the purpose of carrying a research expedition which will shortly proceed to South Polar waters. In this undertaking the Colonial Office, the government of the Falkland Islands, the Admiralty, the British Museum authorities, the Ministry of Fisheries and the Royal Geographical Society are interested. It is understood that the chief objective is concerned with research in connection with the whaling industry in the Falkland Islands Dependencies, and that oceanography, meteorology and other sciences will also be studied. Dr. S. W. Kemp, superintendent of the Zoological Survey of India, has been appointed director of research to the expedition, and the *Discovery* will be commanded by Lieutenant-Commander J. R. Stenhouse, R.N.R., one of the late Sir Ernest Shackleton's officers.

The British Medical Journal writes: "William Harvey died in his eightieth year on June 3, 1657, and on June 26 his remains were deposited in a vault adjoining the parish church of Hempstead in Essex. He was 'lapt in lead,' and on his breast in great letters was his name, 'Doctor William Harvey.' By the middle of the last century this vault underneath the Harvey Chapel had become ruinous. On January 28, 1882, the tower of the church fell towards the southwest; it is still a heap of stones in the churchyard. On October 18, 1883, the body was removed from the vault and placed with all due reverence in a handsome white marble sarcophagus erected by the Royal College of Physicians of London in the chapel above the vault. With it was deposited a leaden case containing the edition of the works of Harvey published by the college in 1766, and a vellum memorial recording the circumstances of the removal. It is now proposed to restore the fallen church tower as a further memorial to William Harvey. The village of Hempstead lies in a sparsely populated agricultural district, seven miles from the railway station of Saffron Walden and some fifty from London. It is therefore necessary to make a far-reaching appeal for the sum of £5,000 which is neeed to carry out the project. The clergy of the diocese and the Royal College of Physicians have given their hearty support, and a committee has been set up, including the bishops of the three neighboring dioceses; the president and

other distinguished fellows of the Royal College of Physicians; Sir H. K. Anderson, M.D., master of Gonville and Caius College, Cambridge (of which Harvey was a member); Sir Charles Sherrington, M.D., president of the Royal Society; Sir Archibald Garrod, M.D., Regius professor of medicine at Oxford; Sir D'Arcy Power; and Dr. A. D. Brenchley, Master of the Society of Apothecaries. The chairman is Lord Stanmore, treasurer of St. Bartholomew's Hospital, to which Harvey was physician. Donations from members of the medical profession may be sent to Dr. Sidney Phillips, joint honorary secretary of the fund, at the Royal College of Physicians, Pall Mall, S.W.1."

UNDER the general supervision of Dr. William Gates, director of the department of Middle American Research of Tulane University, the first Tulane expedition, led by Franz Blom (lately with the Carnegie Institution) is on a five months' tour above the Tehuantepec line, visiting many little known or unvisited Maya sites, through Tabasco, Chiapas, Guatemala and out through Peten and Belize. Last November the state of Tabasco invited the New Orleans Association of Commerce to send as its guests a commission to look into the needs and possibilities of that state. The commission represents the Association of Commerce, Tulane and Louisiana State Universities and various local interests, and includes Congressman O'Connor and a member representing the joint banks. The Tabasco state government has requested Tulane University to organize an agronomic plant survey for two years. This will be undertaken by Mr. Earl S. Haskell and A. C. Hartenbower, men who are familiar with conditions in South America, the Philippines, Guam and Mexico, and by Drs. Walter Evans and Spillman, of the Department of Agriculture. Dr. Gates writes that this and work initiated in Honduras are the beginning of a far-reaching program of tropical plant research.

UNIVERSITY AND EDUCATIONAL NOTES

GROUND has been broken at the University of Pennsylvania for an anatomical laboratory to cost $1,300,000.

THE University of Cincinnati has received $400,000 from a group of donors for the erection of a new hospital.

DR. JOHN M. THOMAS, president of Pennsylvania State College since 1921, has been elected president of Rutgers University, New Brunswick, N. J. Dr. Thomas succeeds President William H. S. Demarest, who resigned July 1, 1924.

DR. PARKE R. KOLBE has resigned as president of the Municipal University of Akron to accept the presidency of the Polytechnic Institute of Brooklyn. He succeeds President Frederick Atkinson, who becomes president emeritus.

DR. DEAN LEWIS, of the Rush Medical School, has been appointed head of the department of surgery at the Johns Hopkins University Medical School and surgeon-in-chief to the hospital.

DR. ALBERT W. GILES, associate professor of geology at the University of Virginia and acting state geologist, has been advanced to a professorship in geology.

DONALD H. MCLAUGHLIN, chief geologist of the Cerro del Pasco Mining Corporation in Peru, has been named professor of mining engineering at Harvard University.

NEW appointments at George Washington University, Washington, D. C., for the academic year 1925–1926 include the following: Colin Mackenzie Mackall, Ph.D. (Johns Hopkins), of St. Johns College, to be professor of chemistry; James R. Randolph, of the U. S. Bureau of Standards, to be assistant professor of mechanical engineering; Franklin L. Hunt, Ph.D. (Mass. Inst. Tech.), of the Bureau of Standards, to be lecturer in physics; Benjamin Douglas Van Evera, of Iowa State University, to be instructor in chemistry; John Philip Mason, of Princeton University, to be instructor in chemistry; William F. Roeser, of the Bureau of Standards, to be instructor in electrical engineering, and Carl J. Frederick, of Nebraska Wesleyan University, to be instructor in physics.

DR. EDWARD A. STRECKER, of the Pennsylvania Hospital for the Insane, has been appointed professor of nervous and mental diseases at Jefferson Medical College to succeed Dr. Francis X. Dercum, who resigned last April, and Dr. William M. Sweet, professor of ophthalmology at the graduate school of the University of Pennsylvania, has been elected to the chair of ophthalmology to fill the vacancy left by the resignation of Dr. Howard F. Hansell.

DISCUSSION AND CORRESPONDENCE

A NEW BACTERIAL DISEASE OF TOMATO FRUITS

A DISEASE of tomatoes which caused big losses to the growers occurred last June in Texas, and in August and September in Nebraska. The disease is first noticed in green full-grown tomatoes, but it is hard to detect at this stage unless close attention is given to the stems. When the fruits are green they show a little brown spot or a dark ring around and under the stem. As the fruit is shipped green,

the packers may overlook this condition very easily. When the tomatoes reach their destination they have become a pink color, the disease has advanced and shows more plainly, for the stem end has then become a dark brown. The inspector notices this and, although there is not much external evidence of disease, he breaks the fruit open and finds a hard brown center. The rot is usually down the center and may extend from stem end to blossom end but sometimes it takes an oblique course and includes a portion of the seeds, darkening them also. There is no slime or ooze.

Bacteria occur in great numbers in the tissues. The same organism was isolated from both the Texas and Nebraska material and the disease was reproduced in green and ripening fruits in the greenhouse, using pure cultures. The dark stem end and hard brown heart formed in the inoculated fruits exactly as in the field. Successful inoculations were obtained last summer by means of needle punctures and this spring good infections have been produced by smearing cultures on the stem and blossom end without puncturing.

Infection occurs mostly at the stem portion where the tough cuticle of the fruit ends, leaving a place where the bacteria can work into the more permeable tissue beneath the caylx. Secondary infection and soft rot may occur with the entrance of fungi and other bacteria. These conditions, however, were found to be rare in the material received. So far as known no infection of the leaves or stem occurs and inoculations on these parts up to this time have been unsuccessful.

The organism causing this disease is a yellow, polar-flagellate species, the biology of which is now under consideration.

NELLIE A. BROWN

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HUMAN CONSTITUTION IN RELATION TO DISEASE

IT is unfortunate that Dr. Draper in his interesting report of his study of human constitution in relation to disease[1] should give, even in a report of progress, a sample of dangerously inadequate statistics. The average anthropometric measurements of persons suffering from contrasted diseases which he cites do indeed "differ widely"; but any one who has worked with statistics must realize that such differences in averages may none the less be totally lacking in significance. We might accept Dr. Draper's statement that the proper measures of reliability and variability had been computed and found satisfactory in accord with accepted standards. But surely it is time that scientists cease the practice of presenting bare averages as if these by themselves were adequate to establish anything at all, even a presumption. I do not suppose Dr. Draper guilty of such statistical ignorance; but when he mentions the fact of distinct overlapping of types, yet fails to give any indication of the extent of overlapping, he clearly gives a wholly misleading impression of the proper way to handle such data.

One other point: Dr. Draper is clearly aware, when treating morphologic and physiologic traits, of the difficulty of finding baseline characters for the assignment of types. But as is unfortunately too common, his caution somewhat deserts him in considering the "psychic panel." Here he seems assured, at least, that there is a definitely marked "feministic trend in their psychic pattern." Psychologists would be glad to know just what this feministic trend is and, particularly, the evidence that it is idiotypic.

HORACE B. ENGLISH

ANTIOCH COLLEGE

[1] Draper, George. "The Relationship of Human Constitution to Disease," SCIENCE, LXI: 525–528, May 22, 1925.

LITERATURE ON EARTHWORMS

SEVERAL years ago the writer beginning research "on his own" asked for information as to literature on the earthworms (*Oligochaetes*) from the National Research Council and was told by one of its members to get the cards on that group from the Concilium Bibliographicum. The writer ordered these cards with the hope of getting a fairly complete bibliography of papers published during the years covered by the cards. The incompleteness of the references is surprising. For instance, in the years '07–'22 inclusive, titles of 47 articles on Indian forms alone are missing. Of the forty-seven thirty-three were by one man. These appeared in the following journals:

Annals and Magazine of Natural History	2
Proceedings of the Zoological Society	2
Quarterly Journal of the Microscopical Society	1
Transactions of the Royal Society, Edinburgh	7
Memoirs of the Asiatic Society, Bengal	1
Memoirs of the Indian Museum, Calcutta	5
Records of the Indian Museum, Calcutta	14
Spolia Zeylanica	1

It should be noted that the majority of the missing titles contain either the word "Earthworm" or "Oligochaeta."

GORDON E. GATES

JUDSON COLLEGE
RANGOON, BURMA

SCIENTIFIC BOOKS

The Origin of Continents and Oceans. By ALFRED WEGENER, 1922. (Translated from the Third German Edition by J. G. A. Skerl, New York, 1924, E. P. Dutton and Co.)

THIS book is a translation of the well-known publication by Professor Alfred Wegener, of the University of Graz, Austria, "Die Entstehung der Kontinente und Ozeane."[1] (Vieweg, 1922.)

Since the first presentation of Professor Wegener's theory of continental sliding, in 1912, European geologists have given it considerable attention. In North America, however, it has remained essentially unknown, and the publication of this translation is to be welcomed for the opportunity it will give American geologists to study the theory for themselves.

In short, the theory postulates the existence of only one continent on the earth up to Permo-Carboniferous time, when it began to break up into the present continents, North and South America sliding westward from Europe and Africa, and Antarctica and Australia sliding southward and southeastward—leaving the Indian Ocean in their wake. The movement has been more or less continuous up to the present and has progressed, of course, at a very slow rate. Labrador and Greenland have, according to the theory, been separated from northern Europe since the maximum extension of the Pleistocene ice cap. It is even held that longitude observations reveal a present westward drift of Greenland, and this point, together with similar data for other places, constitute part of the more important evidence.

An important feature of the theory is the wandering of the earth's axis of rotation with respect to the continents. (Whether there has been a change of the axis within the body of the earth is left an open question.) In Permo-Carboniferous time the south pole was situated at the southeastern extremity of Africa. Thus, with one orientation, the author accounts for the Permo-Carboniferous glaciation of South America, Africa, India and Australia (which were clustered about South Africa at that time), also for the tropical coal basins arranged along the Permo-Carboniferous equator, and likewise, for the desert regions, as shown by the "red beds" which were formed 20 to 40 degrees north of this equator. The positions of the poles are also established from Silurian time to the present, though the evidence, for other geologic periods than the Carboniferous, is not so definite and hence the determinations are more tentative.

The theory is a natural outgrowth of unreserved acceptance of a condition of perfect isostatic balance for the earth's crust. Without the isostatic foundation the "displacement" theory, as it stands, could by no means have been developed. It is postulated that somewhat "rigid" continental sheets (sial), which are about 100 kilometers thick, float in a more viscous, basaltic stratum (sima), which is exposed on the ocean bottoms, and which is thought to extend to a depth of about 1,500 kilometers. Gravitational and tidal forces are supposed to set up differential stresses sufficient to cause movement of the continental blocks through the less rigid "sima."

Evidence for the former union of continents consists of material taken from various fields, such as the matching of geological formations and intrusive bodies on opposite sides of the continental rifts, comparison of living faunas and floras, assembling and correlating the facts of paleoclimatology, together with facts drawn from the fields of geophysics and geodetics.

The displacement theory seems to be especially weak in its excessive demands on the very small forces available to produce sliding of continental masses. It is likewise apparently on very insecure ground when it attempts to draw, from the facts of Pleistocene glaciation, evidence for the very recent separation of North America, Greenland and Europe. Most American geologists will also believe that Professor Wegener is without sufficient foundation in his extreme acceptance of a fluid and viscous earth. Moreover, a careful review of the evidence for a westward drifting of Greenland by Sir Charles Close (*Geographic Journal,* Vol. 63, p. 147, 1924), has resulted in his finding that the evidence available at present is inconclusive, and that another exact determination of longitude at one of the Greenland stations, in about ten years, by means of wireless signals, should settle the question.

Even though the theory is highly heterodox in the eyes of many American geologists, the book is, nevertheless, an able presentation of the subject. A great number of very suggestive facts have been marshalled in support of this interesting doctrine. Considerable leeway is, in all fairness, to be allowed the author in the presentation of such a revolutionary conception.

A large European literature has already grown up around this hypothesis and, in America, Coleman, Daly and Washington[2] have recently contributed to the discussion.

[1] A contributory volume has lately been published by W. Köppen and the author ("Die Klimate der geologischen Vorzeit," Berlin, Borntraeger).

[2] Coleman, A. P., "Ice ages and the drift of continents," *Amer. Jour. Sci.,* Vol. 7, 1924, pp. 398–404.

Daly, R. A., "The earth's crust and its stability," *Amer. Jour. Sci.,* Vol. 5, 1923, pp. 349–371.

Daly, R. A., "Decrease of the earth's rotational velocity and its geological effects," *Amer. Jour. Sci.,* Vol. 5, 1923, pp. 372–377.

Washington, H. S., "Comagmatic regions and the Wegener hypothesis," *Jour. Wash. Acad. Sci.,* Vol. 13, Sept., 1923, pp. 339–347.

The translation has been very carefully made. In fact, the degree of literality is, in many places, so great that good English usage is not found. This is, however, probably to some extent intentional on the part of the translator, for the sake of exactness in presenting the author's views. Mr. Skerl has done a valuable piece of work in presenting this translation to English-speaking investigators.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

REGELATION AND LOW TEMPERATURES

EVERY year we show the freshman class in physics that a loaded wire will cut through a block of ice leaving the block intact. Every year the students read the insufficient discussions in their text-books (there is one recent text that does explain fully), most of them not getting beyond "The pressure melts the ice." If pushed for a further analysis, they say that the energy to melt the ice comes from the descending weight, and they accordingly conclude that the cutting of the block would go on at any temperature.

After several years of arguing, finding the students uniformly unconvinced and even the instructors often doubtful, and never in the whole time having met an inquirer who had seen the experiment tried at low temperatures, I decided to bolster up "I can see, with my mind's eye" with "I have seen with my own eyes."

A rectangular block of ice, taken from the refrigerator and treated in the usual manner, was cut through by the loaded wire in forty minutes. The whole apparatus was then put out of doors for several hours and then the wire loaded as before. During the eighteen hours that the experiment was continued the temperature of the surrounding atmosphere varied from 0° Fahr. to −20° Fahr. In that time the only effect of the wire on the ice was a mechanical chipping out of a bit at each of the sharp upper corners of the block. Across the top of the block the wire touched only the highest points and even there produced no observable effect.

This experiment is reported as just one more instance where the time and energy required to make the convincing test is but a small fraction of the time and energy spent in fruitless office-chair debate about how nature ought to operate.

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SPECIAL ARTICLES

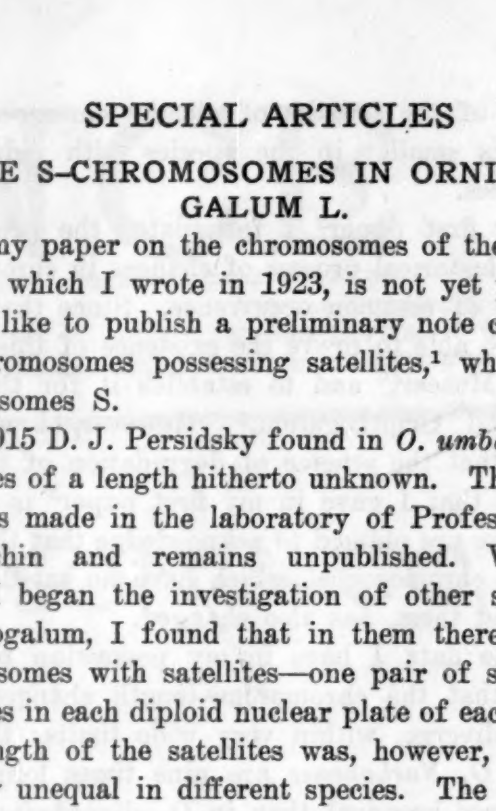
THE S-CHROMOSOMES IN ORNITHOGALUM L.

As my paper on the chromosomes of the Ornithogalum, which I wrote in 1923, is not yet printed, I should like to publish a preliminary note concerning the chromosomes possessing satellites,[1] which I call chromosomes S.

In 1915 D. J. Persidsky found in *O. umbellatum* L. satellites of a length hitherto unknown. This discovery was made in the laboratory of Professor S. G. Nawaschin and remains unpublished. When, in 1921, I began the investigation of other species of Ornithogalum, I found that in them there are also chromosomes with satellites—one pair of such chromosomes in each diploid nuclear plate of each species. The length of the satellites was, however, found to be very unequal in different species. The same can be stated also about the length of the "body" itself of the chromosomes S. Nevertheless, I take it for certain that the S-chromosomes of one species are homologous with the S-chromosomes of the others.

The S-chromosomes are easily distinguishable and therefore very convenient for comparative studies.

In Fig. 1 are represented the S-chromosomes of three species: *O. Narbonense* L. (N), *O. tempskyanum* Fr. et Sint. (tp) and *O. oligophyllum* Clarke (o).



The satellites of *O. umbellatum*, studied by D. J. Persidsky, are still longer than those of *O. Narbonense*.

The lengths of all the other chromosomes of Ornithogalum are also unequal in different species, and

[1] See Tischler, G., 1922. Allgemeine Pflanzenkaryologie, Berlin, Borntraeger, pp. 526 and 632.

the sum of the lengths of all the chromosomes of the set is smaller in the species with reduced inflorescences.

In my first paper[2] I formulated the proposition that the historical process of changes in chromosome-length is of common occurrence. Since that time I have been able to prove the existence of this process for the Muscari[3] and to establish it for the Bellevalia[3] and Ornithogalum.[4] However, I admit at present that the scheme of degradation of the chromosomes that I gave in my first paper[5] is not universal: we are obliged to acknowledge that the length of those chromosomes, which have no satellites, and never had them, has also changed.

All the data I have in my possession point out clearly that the chromosome-length changes as the species diverge, within very wide limits: the satellites in *O. Narbonense* are nine times longer (and three times broader) than in *O. oligophyllum!* The bodies of the S-chromosomes are in the first species twice as long as in the second.

The historical process of the change of the chromosome-length is one of those phylogenetic processes which must be established by the comparative study of chromosomes in different systematic groups.

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THE AMERICAN CHEMICAL SOCIETY

SECTION OF HISTORY OF CHEMISTRY

F. B. Dains, *chairman*
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Chemistry in old Georgia: C. J. BROCKMAN. There was no Colonial chemistry in Georgia. From the time of its foundation as a colony in 1732 until the expulsion of the British in 1782 Georgia, as a colony, was dependent upon its sister colonies for its explosives and even its rum. The University of Georgia was founded in 1785, but was not active until about 1807 under the presidency of Josiah Meigs, a Yale graduate who introduced the study of "Chemistry, with actual experimental demonstration of its principles." Apparatus for the course in "Philosophical Investigations" to the extent of 205 pounds sterling was imported. Natural philosophy was divided in 1822 into separate parts, *i.e.*, physics and chemistry. Dr. Henry Jackson became professor of natural philosophy in 1811 and was given leave of absence to serve as secretary of the legation at Paris a few years later. A scientific library valued at several thousands of dollars was maintained. In 1854 a gift of $20,000.00 was made by Terrell to advance the knowledge of agriculture. This gift is unique in the history of the science. The course of lectures to be given was to include: (1) Agriculture as a science; (2) practice and improvements of different people; (3) chemistry and geology so far as they may be useful in agriculture; (4) manures; (5) analysis of soils; (6) domestic economy, particularly referring to the southern states. The aid of Dr. White, of the chemical department, in tracing some of this information is appreciated.

Chemistry and alchemistry in the Arabian nights: C. J. BROCKMAN. The Arabs were the people who preserved the Greek culture during the Dark Ages and then brought it into western Europe. From the advent of Mahomet to the Renaissance, Arabian culture was spread into Egypt, Morocco and Spain by the fanaticism which was peculiar to Islam. Most of this culture has been lost through religious and racial prejudices. Very slowly the records are being searched for information that will reveal the glories of the Arabic influence when at the height of the tide. The "Arabian Nights Entertainments" are probably the only extant authority on the Arabic "folk-lore" from Mahomet to the disintegration of his empire. These tales contain much that is fantastic and supernatural, but in the background there must be something of real historical value. The "Nights" contain many references and inferences concerning the use of chemical substances as cosmetics, drugs, foods, etc., and for the transmutation of metals. The Houris and the dancing girls colored their finger and toe nails with henna and blackened their eyelashes and eyelids with "kohl," from which word is derived our present term alcohol. The Bedouin understood the uses and applications of aphrodisiacals as a cure for impotence, one of the horrors of old age. The hypnotics, sedatives and narcotics as bhang, hashish, henbane and hemp found extensive use. Gum benzoin measured by volume was a criterion of female physical beauty. Leather, metals, synthetic drinks and foods, earthenware and glass vessels were manufactured in quantity. Beer and wines were used for the purpose of producing intoxication, not for social courtesy. An anti-intoxicant was found in myrtle which also served the dual purpose of a flavor for new brandy. Extensive directions are often given for the transmutation of lead and mercury into gold and silver. Extraordinary combinations of foods and drugs were prescribed as cures for leprosy and other dread diseases. The Arabian Nights in places could easily be called the popular chemistry of the Arabs. Though very voluminous and not by any means a treatise on the chemistry of the age, the Nights possess a fascination which makes them what is now called "interesting reading."

LYMAN C. NEWELL,
Secretary

[2] Delaunay, L., 1915. Étude comparée caryologiques de quelques espèces du genre Muscari. Comm. prélim. Mém. Soc. Natur. Kiew, vol. 25, pp. 33–64, pl. 1, fig. 1–2. (Russian with French résumé.)

[3] Delaunay, L., 1922. Vergleichende karyologische Untersuchungen einiger Muscari- und Bellevalia- Arten. Moniteur du Jardin Botan. de Tiflis, série 2, livr. 1, pp. 1–32, fig. 1–11. (Russian with very short German résumé.)

[4] The unpublished article.

[5] *L.c.*, p. 51, fig. 2. See also Tischler, G., 1922. Allg. Pflanzenkar., p. 632, fig. 375.